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㊹発明の名称　ズーム型ストロボ閃光器

㉑特　願　昭63−67963

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明　細　書

1．発明の名称

ズーム型ストロボ閃光器

2．特許請求の範囲

照明光学系の光軸を含む断面が略半円筒形をなす反射器と、反射器の底部に配置されたストロボ閃光管と、反射器の開口部側に配置された凸フレネルレンズとからなり、前記反射器および閃光管が前記レンズに対して相対移動可動なズーム型ストロボ閃光器において、前記凸フレネルレンズ側に、前記ストロボ閃光管を有する反射器の外側に位置し、かつ該反射器に向って縮径する補助反射板を設けたことを特徴とするズーム型ストロボ閃光器。

3．発明の詳細な説明

「技術分野」

本発明はカメラ等に用いられるストロボ閃光器に関し、特に小型化および高い集光効率を得ることが可能なズーム型ストロボ閃光器に関する。

「従来技術およびその問題点」

第8a図および第8b図は、従来のズーム型ストロボ閃光器の概略を夫々照射角が最も大きい状態（ワイド時）と小さい状態（テレ時）とで示す縦断面図である。この閃光器は、略半円筒状をなす反射器13の底部に、これと長手方向が一致するようにストロボ閃光管（例えばキセノン管）17が配置され、また反射器13の前面開口部側に集光レンズである凸フレネルレンズ15が配置される。凸フレネルレンズ15はカメラ本体に固定され、反射器13および閃光管17が該レンズ15に対して一体的に移動調整可能となっている。従ってこの移動調整により、両図に示すように、ワイド時（反射器13がレンズ15に最も接近する時）とテレ時（反射器13がレンズ15から最も遠ざかる時）との間の照射角の変更を行うことが可能となっている。

上記従来の構造にあっては、第8b図に示すように、テレ時において光が反射器13を外れて広がるため、あまり良好な集光状態を得難いという

問題があった。第９図はこの従来構造におけるワイド時の配光特性Ａと、テレ時の配光特性Ｂの一例を示すもので、テレ時における集光状態がワイド時に比べてそれ程際立っていない。理想的な最テレ時における集光状態は例えば第７図中に曲線Ｃに示すようなものであるが、従来の構造を用いてこのように集光効率を高めるには、凸フレネルレンズ１５を大型化したり、テレ時における反射器１３と凸フレネルレンズ１５との間隔を大きくしなければならない。然しこのような変更はストロボ閃光器全体の大型化をまねくという問題がある。

「発明の目的」

本発明は、このような従来技術の欠点を改良し、テレ側において高い集光効率が得られ、しかも小型化が可能なズーム型ストロボ閃光器を提供することを目的とする。

「発明の概要」

本発明は、特にテレ側における集光効率を高めるために、凸フレネルレンズと、ストロボ閃光管を有する反射器とが離れるテレ側において、反射器から出る光を光軸側に屈曲させる補助反射板を設けたものである。

すなわち本発明は、照明光学系の光軸を含む断面が略半円筒状をなす反射器と、反射器の底部に配置されたストロボ閃光管と、反射器の開口部側に配置された凸フレネルレンズとからなり、前記反射器および閃光管が前記レンズに対して相対移動可能なズーム型ストロボ閃光器において、凸フレネルレンズ側に、ストロボ閃光管を有する反射器の外側に位置し、かつ該反射器に向って縮径する補助反射板を設けたことを特徴としている。

上記構成により本発明に係る閃光器にあっては、テレ側において反射器を外れて広がろうとする光は補助反射板で反射して拡散を阻止され、凸フレネルレンズを通過するため、集光効率が高まる。

「発明の実施例」

第１図は本発明に係るズーム型ストロボ閃光器の一実施例の内部を示す正面図、第２図はそのテレ時における横断面図、第４図はやはりテレ時における同閃光器の要部を拡大して示す縦断面図である。

反射器２３は照明光学系の光軸を含む断面において互いに離間した光軸を有する２つの同一の楕円２３ａ、２３ｂを組合せた略半円筒状体からなる。両楕円２３ａ、２３ｂの光軸は平行で、間隔ℓだけ離間されている。

反射器２３の底部には、これと長手方向が一致するようにストロボ閃光管（キセノン管）２７が配置される。閃光管は発光部２７ａとこれを覆うガラス管部２８とからなる。発光部２７ａは、直径が前記間隔ℓと等しく、その中心を反射器２３の光軸２９に中心を合わせると共に、径方向の両端が前記両楕円２３ａ、２３ｂの焦点ｅの位置に一致するように配置される。従ってストロボ閃光管２７のガラス管部２８の奥部分は反射器２３の頂点より後方に突出し、これに形状を合わせて反射器２３に該管部２８と同じ曲率の曲線部２４が形成され、両楕円２３ａ、２３ｂを連結する。

反射器２３の開口部側には集光レンズである凸フレネルレンズ２５が配置される。このレンズ２５は、その前面即ち閃光管２７とは逆側の面に、第３図図示のような同心円状のフレネル溝２６が位置するように配置される。この配置はフレネル溝２６を閃光管２７側に位置させた場合に比べて溝による「ケラレ」が少なくなる点で好ましい。ここで「ケラレ」とは、光が何等かの障害により集光作用に寄与しなくなることを云い、この点に関する詳細は本出願人の出願による特願昭61-55742（特開昭62-211627）において説明されており、本発明の要旨ではない。

レンズ２５の後面外周部には、反射器２３の外側に位置し、反射器２３に向って径を縮める補助反射板３２が固定されている。この補助反射板３２の全体形状は、反射器２３の全体形状に対応していて、この実施例では、その上下壁が光軸２９に向かって角度αで傾斜している。反射器２３はこの補助反射板３２の内部に進退可能であり、最テレ時においては、第２図および第４図に

示すように、反射器２３の前端開口縁部と、補助反射板３２の後端開口内縁部とが実質的に隙間なく連続する。

第６ａ図および第６ｂ図は、本発明に係るズーム型ストロボ閃光器の作動を示す概略縦断面図である。

第６ａ図の最ワイド時において反射器２３は、その開口縁部がレンズ２５に接触するまでこれに接近して用いられる。この時補助反射板３２は実質的に用をなさず、従ってここで得られる配光特性は、第７図中に曲線Ａで示すように、従来の構造において最ワイド時に得られる配光特性と同一である。

他方、第６ｂ図の最テレ時においては、反射器２３は、レンズ２５から遠ざけられ、その前端開口縁部と補助反射板３２の後端開口内縁部とが連続する状態となる。すると、反射器２３を外れて広がろうとする光は、同図中に光線図として示すように、補助反射板３２で反射して拡散を阻止され、レンズ２５を通過する。従ってここで得られる配光特性は第７図中に曲線Ｃで示すように、集光効率が高くなる。すなわちレンズ２５の径が従来品に比べて小さく且つ反射器２３とレンズ２５との間隔を大きくとらなくとも、従来の　造において得られる配光特性に比べて集光効率のよいものが得られる。

また最ワイド時と最テレ時の中間においては、反射器２３の補助反射板３２に対する位置に応じて、反射器２３を出た光の一部が補助反射板３２で反射し、集光効率を高める。

なお、レンズの焦点距離が35～70mmの場合に適合する本ストロボ閃光器の具体的設計数値をあげると次の通りである。

反射器２３の楕円２３ａ、２３ｂの長軸Ｘ（第５図参照）の長さ；16.594mm

同短軸Ｙ（同）の長さ；5.275mm

楕円２３ａ、２３ｂの光軸間の間隔ℓ；2mm

反射器の楕円の頂点ｔまでの深度Dp;7.934mm

楕円の頂点ｔと楕円の焦点ｅの位置との間隔Fp; 0.861mm

反射器の縦断面の開口部長さD; 11mm

補助反射板の深度dp;7mm

補助反射板の傾斜角α；23.364°

補助反射板の縦断面の最大長さd;17mm

凸フレネルレンズの焦点距離f;25mm

「発明の効果」

本発明に係るズーム型ストロボ閃光器によれば、反射器の外側に補助反射板を設けることにより、テレ時における集光効率が高くなる。しかも集光効率が高まるにも拘わらず、凸フレネルレンズの径は従来品に比べて小さくすることができ、またテレ時における反射器と該レンズとの間隔も大きくとる必要がなく、従ってストロボ閃光器全体を小型化することが可能となる。

４．図面の簡単な説明

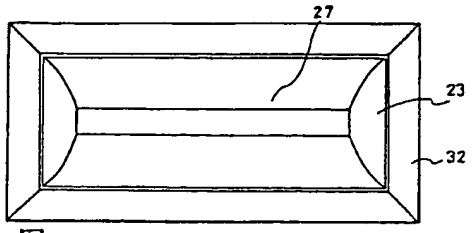
第１図は本発明に係るズーム型ストロボ閃光器の一実施例の内部を示す正面図、第２図はその最テレ時における横断面図、第３図は凸フレネルレンズの正面図、第４図は本閃光器の最テレ時における要部の縦断面図、第５図は反射器で用いられている楕円を示す図、第６ａ図および第６ｂ図は本閃光器の作動を示す概略縦断面図、第７図は本閃光器による配光特性を示す図、第８ａ図および第８ｂ図は従来のズーム型ストロボ閃光器の概略縦断面図、第９図は従来の閃光器による配光特性を示す図である。

１３…反射器、１５…凸フレネルレンズ、１７…ストロボ閃光管、２３…反射器、２３ａ，２３ｂ…楕円、２５…凸フレネルレンズ、２６…フレネル溝、２７…ストロボ閃光管、２７ａ…発光部、２８…ガラス管部、２９…光軸、３２…補助反射板。

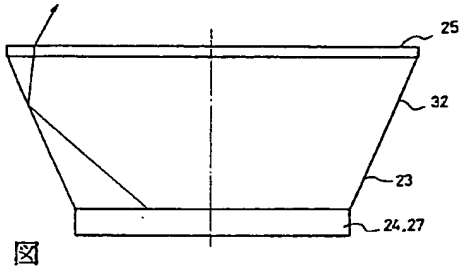
特許出願人　旭光学工業株式会社

同代理人　三浦邦夫

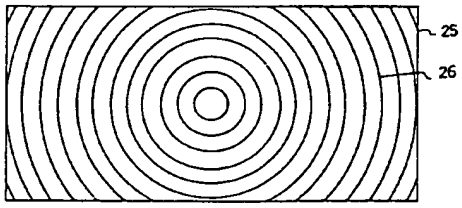
同　笹山喜英



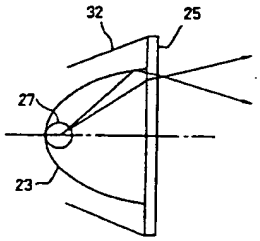
第 1 図



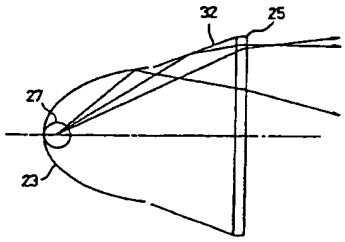
第 2 図



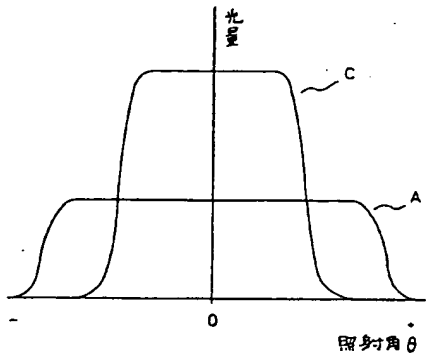
第 3 図



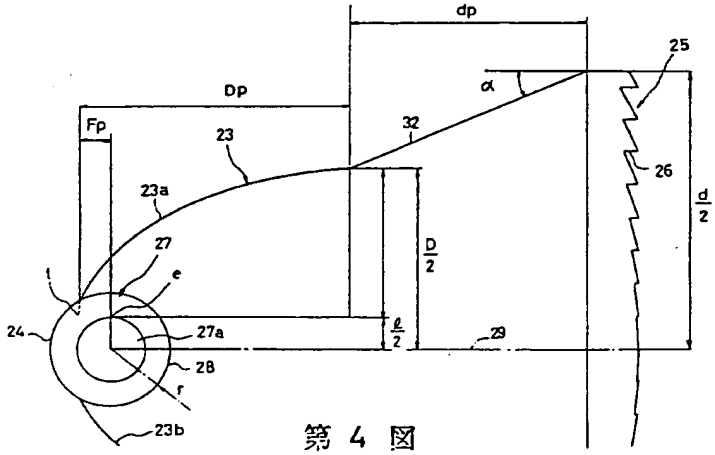
第6a図



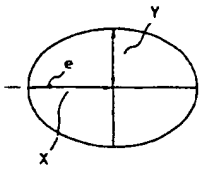
第6b図



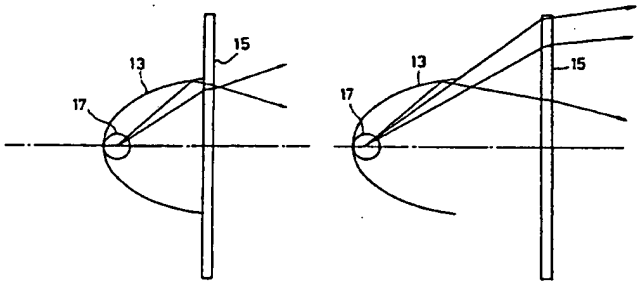
第 7 図



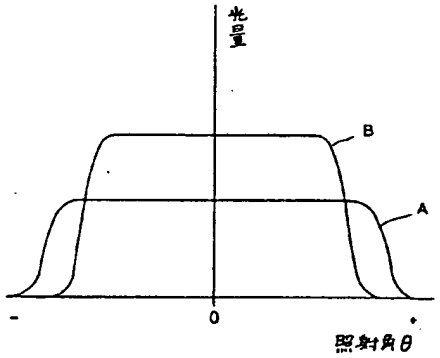
第 4 図



第 5 図



第 8a図　　第 8b図

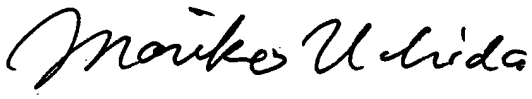


第 9 図

Date: July 7, 2003

Declaration

I, Mariko Uchida, a translator of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation, of the copy of Japanese Unexamined Patent No. Hei-1-239541 laid open on September 25, 1989.



Mariko Uchida

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ZOOM-TYPE STROBE FLASH UNIT

Japanese Unexamined Patent No. Hei-1-239541

Laid-open on: September 25, 1989

Application No. Sho-63-67963

Filed on: March 22, 1988

Inventor: Saburo SUGAHARA

Applicant: Asahi Optical Co., Ltd.

Patent Attorney: Kunio MIURA

SPECIFICATION

1. TITLE OF THE INVENTION

Zoom-type strobe flash unit

2. WHAT IS CLAIMED IS;

A zoom-type strobe flash unit which comprises a reflector whose section including the optical axis of an illuminating optical system forms an approximately semicylinder, a strobe flash tube arranged on the bottom portion of the reflector, and a convex Fresnel lens arranged on the opening portion-side of the reflector and in which said reflector and flash tube are relatively shiftable with respect to said lens, wherein

on the side of said convex Fresnel lens, provided is an

auxiliary reflecting plate which is positioned outside said reflector having the strobe flash tube and whose diameter is reduced toward the reflector.

3. DETAILED DESCRIPTION OF THE INVENTION

[Field of the Invention]

The present invention relates to a strobe flash unit to be used for a camera, etc., and in particular, the present invention relates to a zoom-type strobe flash unit in which downsizing and obtaining a high condensing efficiency are possible.

[Prior Arts and Problems Thereof]

Fig. 8a and Fig. 8b are longitudinal sectional views showing an outline of a conventional zoom-type strobe flash unit in a condition where the irradiation angle is maximum (wide state) and in a condition where the same is minimum (tele state), respectively. For this flash unit, on the bottom portion of a reflector 13 which forms an approximately semicylindrical shape, a strobe flash tube 17 (a xenon tube, for example) is arranged so as to coincide with the same in the longitudinal direction, and a convex Fresnel lens 15 of a condenser lens is arranged on the side of a front-surface opening portion side. The convex Fresnel lens 15 is fixed to a camera body, and the reflector 13 and flash tube 17 are integrally capable of

shifting adjustment with respect to this lens 15. Accordingly, it is made possible by this shifting adjustment to change the irradiation angle between a wide state (where the reflector 13 becomes closest to the lens 15) and a tele state (where the reflector 13 becomes furthest from the lens 15), as shown in both drawings.

In the above-described conventional structure, as shown in Fig. 8b, since light diverges while deviating from the reflector 13 in a tele state, there has existed a problem such that an excellent condensing condition can hardly be obtained. Fig. 9 shows an example of light distribution characteristics A in a wide state and light distribution characteristics B in a tele state of this conventional structure, wherein the condensing condition in the tele state is not so prominent as that in the wide state. An optimum condensing condition in an extreme tele state is, for example, as shown by a curve C in Fig. 7, however, in order to improve condensing efficiency as such by use of the conventional structure, the convex Fresnel lens 15 must be increased in size and the interval between the reflector 13 and convex Fresnel lens 15 in a tele state must be increased. However, such modifications cause an increase in size of the whole strobe flash unit, therein exists a problem.

[Object of the Invention]

The present invention has been made to improve such drawbacks of the prior arts, and an object thereof is to provide a zoom-type strobe flash unit in which a high condensing efficiency can be obtained at a tele side and downsizing is possible.

[Outline of the Invention]

According to the present invention, in order to improve the condensing efficiency particularly at a tele side, at a tele side where a convex Fresnel lens and a reflector having a strobe flash tube are separated, provided is an auxiliary reflecting plate for bending light emerging from the reflector toward the optical axis side.

Namely, in a zoom-type strobe flash unit which comprises a reflector whose section including the optical axis of an illuminating optical system forms an approximately semicylinder, a strobe flash tube arranged on the bottom portion of the reflector, and a convex Fresnel lens arranged on the opening portion-side of the reflector and in which the reflector and flash tube are relatively shiftable with respect to the lens, the present invention is characterized in that, on the side of the convex Fresnel lens, provided is an auxiliary reflecting plate which is positioned outside the reflector

having the strobe flash tube and whose diameter is reduced toward the reflector.

By the above-described construction, in a flash unit according to the present invention, light which is about to diverge while deviating from the reflector at a tele side is reflected by the auxiliary reflecting plate, prevented from being dispersed, and transmitted through the convex Fresnel lens, therefore, condensing efficiency is improved.

[Embodiment of the Invention]

Fig. 1 is a front view showing the interior of an embodiment of a zoom-type strobe flash unit according to the present invention, Fig. 2 is a cross sectional view in a tele state of the same, and Fig. 4 is a longitudinal sectional view showing, in an enlarged manner, the main part of the same flash unit also in a tele state.

A reflector 23 is composed of an approximately semicylindrical-shaped body formed by combining two identical eclipses 23a and 23b having mutually alienated optical axes at a section including the optical axis of an illuminating optical system. The optical axes of both ellipses 23a and 23b are parallel and are alienated by an interval ℓ.

On the bottom portion of the reflector 23, a strobe flash tube (a xenon tube) 27 is arranged so as to coincide with the

same in the longitudinal direction. The flash tube is composed of a light emitting portion 27a and a glass tube portion 28 to cover the same. The light emitting portion 27a has a diameter equal to the above-described interval ℓ, and is arranged so that its center is aligned with the optical axis 29 of the reflector 23 and both ends in the radial direction coincide with the position of a focal point e of the above-described both ellipses 23a and 23b. Accordingly, a back part of the glass tube portion 28 of the strobe flash tube 27 is protruded backward beyond the top of the reflector 23, and in a shape matched therewith, a curve portion 24 of a curvature identical to that of the tube portion 28 is formed in the reflector 23, whereby both ellipses 23a and 23b are interconnected.

On the side of an opening portion of the reflector 23, a convex Fresnel lens 25 of a condenser lens is arranged. This lens 25 is arranged so that concentric circular Fresnel grooves 26 as illustrated in Fig. 3 are positioned on its front surface, that is, on a surface of the side opposite the flash light tube 27. This arrangement is favorable in terms of "vignetting" due to the grooves being reduced compared to a case where the Fresnel grooves 26 are positioned on the flash tube 27 side. Herein, "vignetting" means a phenomenon where light fails to

contribute toward condensing effect for one drawback or another, and for details concerning this point, description has been given in Japanese Patent Application No. Sho-61-55742 (Japanese Unexamined Patent Publication No. Sho-62-211627) applied by the present inventor, and this is not included in the gist of the present invention.

To a rear-surface outer circumferential portion of the lens 25, an auxiliary reflecting plate 32 which is positioned outside the reflector 23 and whose diameter is reduced toward the reflector 23 is fixed. The whole shape of this auxiliary reflecting plate 32 corresponds to the whole shape of the reflector 23, and in the present embodiment, its upper and lower walls are inclined at an angle α toward the optical axis 29. The reflector 23 can be advanced and retracted inside this auxiliary reflecting plate 32, and in an extreme tele state, as shown in Fig. 2 and Fig. 4, a front-end opening marginal portion of the reflector 23 and a rear-end opening inner marginal portion of the auxiliary reflecting plate 32 are virtually continued with no gap.

Fig. 6a and Fig. 6b are schematic longitudinal sectional views showing operations of a zoom-type strobe flash unit according to the present invention.

The reflector 23 is, in an extreme wide state of Fig. 6a,

used in a manner where its opening marginal portion approximates the lens 25 until coming into contact therewith. At this time, the auxiliary reflecting plate 32 is virtually useless, and accordingly, light distribution characteristics herein obtained are, as shown by a curve A in Fig. 7, identical to light distribution characteristics obtained in an extreme wide state in the conventional structure.

On the other hand, in an extreme tele state of Fig. 6b, the reflector 23 is separated from the lens 25, and its front-end opening marginal portion and the rear-end opening inner marginal portion of the auxiliary reflecting plate 32 result in a continuing condition. Consequently, light which is about to diverge while deviating from the reflector 23 is, as shown in the same drawing as a light ray drawing, reflected by the auxiliary reflecting plate 32, is prevented from being dispersed, and is transmitted through the lens 25. Accordingly, light distribution characteristics herein obtained become high in condensing efficiency as shown by the curve C in Fig. 7. Namely, even if the lens 25 is smaller in diameter than the conventional product and a great interval is not secured between the reflector 23 and lens 25, light distribution characteristics which are better in condensing efficiency than the light distribution characteristics

obtained in the conventional structure can be obtained.

In addition, in an inbetween state between the extreme wide state and extreme tele state, part of the light emerged from the reflector 23 is reflected by the auxiliary reflecting plate 32 according to a position of the reflector 23 with respect to the axially reflecting plate 32, whereby condensing efficiency is improved.

Moreover, concrete numerical design values of the present strobe flash unit suitable for a case of a lens focal distance of 35-70mm are as follows.

Length of the major axis X (refer to Fig. 5) of the ellipses 23a and 23b of the reflector 23; 16.594mm

Length of the minor axis Y (refer to Fig. 5) of the same; 5.275mm

Interval ℓ between the optical axes of the ellipses 23a and 23b; 2mm

Depth Dp to the top t of the ellipses of the reflector; 7.934mm

Interval Fp between the top t of the ellipses and focal point e position of the ellipses; 0.861mm

Length D of the opening portion on a longitudinal section of the reflector; 11mm

Depth dp of the auxiliary reflecting plate; 7mm

Angle α of inclination of the auxiliary reflecting plate; 23.364°

Maximum length d of a longitudinal section of the auxiliary reflecting plate; 17mm

Focal distance f of the convex Fresnel lens; 25mm.

[Effects of the Invention]

According to the zoom-type strobe flash unit of the present invention, by providing the auxiliary reflecting plate outside the reflector, condensing efficiency in a tele state is improved. In addition, despite the improvement in condensing efficiency, the convex Fresnel lens can be made smaller in diameter than the conventional product, and moreover, it is unnecessary to secure a great interval between the reflector and this lens in a tele state, and consequently, downsizing of the whole strobe flash unit becomes possible.

4. BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view showing the interior of an embodiment of a zoom-type strobe flash unit according to the present invention, Fig. 2 is a cross sectional view in a tele state of the same, Fig. 3 is a front view of a convex Fresnel lens, Fig. 4 is a longitudinal sectional view of the main part in an extreme tele state of the present flash unit, Fig. 5 is a view showing an eclipse used in a reflector, Fig. 6a and Fig.

6b are schematic longitudinal sectional views showing operations of the present flash unit, Fig. 7 is a diagram showing light distribution characteristics by the present flash unit, Fig. 8a and Fig. 8b are schematic longitudinal sectional views of a conventional zoom-type strobe flash unit, and Fig. 9 is a diagram showing light distribution characteristics by a conventional flash unit.

13 ... reflector, 15 ... convex Fresnel lens, 17 ... strobe flash tube, 23 ... reflector, 23a and 23b ... ellipse, 25 ... convex Fresnel lens, 26 ... Fresnel grooves, 27 ... strobe flash tube, 27a ... Light emitting portion, 28 ... glass tube portion, 29 ... optical axis, 32 ... auxiliary reflecting plate.

Fig.1

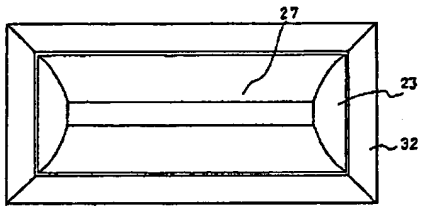

Fig.2

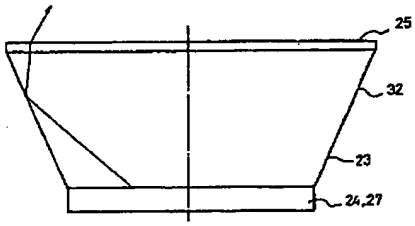

Fig.3

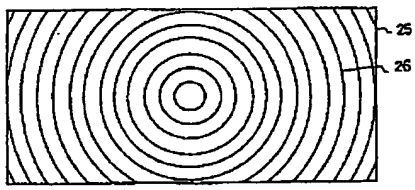

Fig.6a

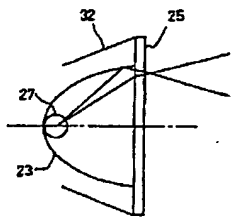

Fig.6b

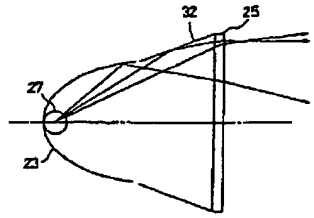

Fig.5

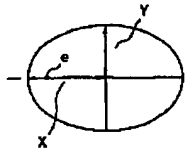

Fig.4

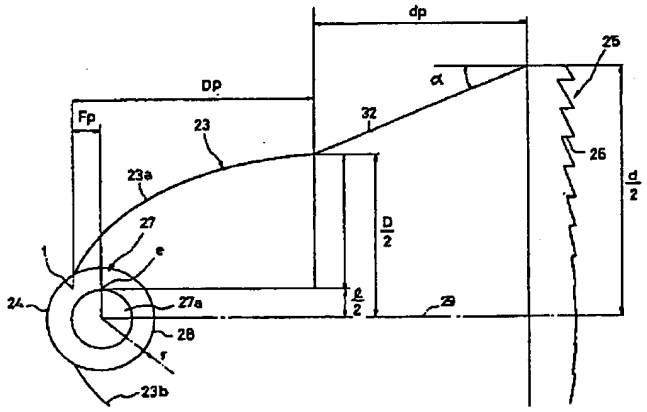

Fig.7

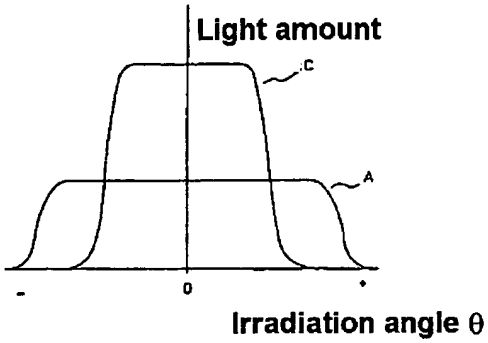

Fig.8a

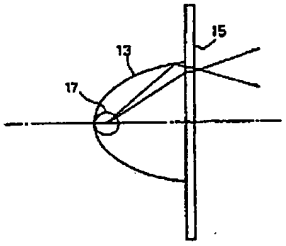

Fig.8b

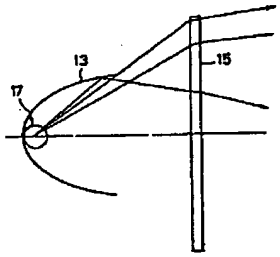

Fig.9